



Jun 5th, 11:00 AM

## Explore Science: Science Exploration Update

Steven W. Clarke

*Deputy Associate Administrator for Exploration in NASA's Science Mission Directorate*

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### Scholarly Commons Citation

Clarke, Steven W., "Explore Science: Science Exploration Update" (2019). *The Space Congress® Proceedings*. 38.

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National Aeronautics and  
Space Administration



# EXPLORE SCIENCE

## Science Exploration Update

**Steve Clarke**

Deputy Associate Administrator for Exploration  
NASA Science Mission Directorate

Space Congress Panel

June 5, 2019





# KEY SCIENCE THEMES

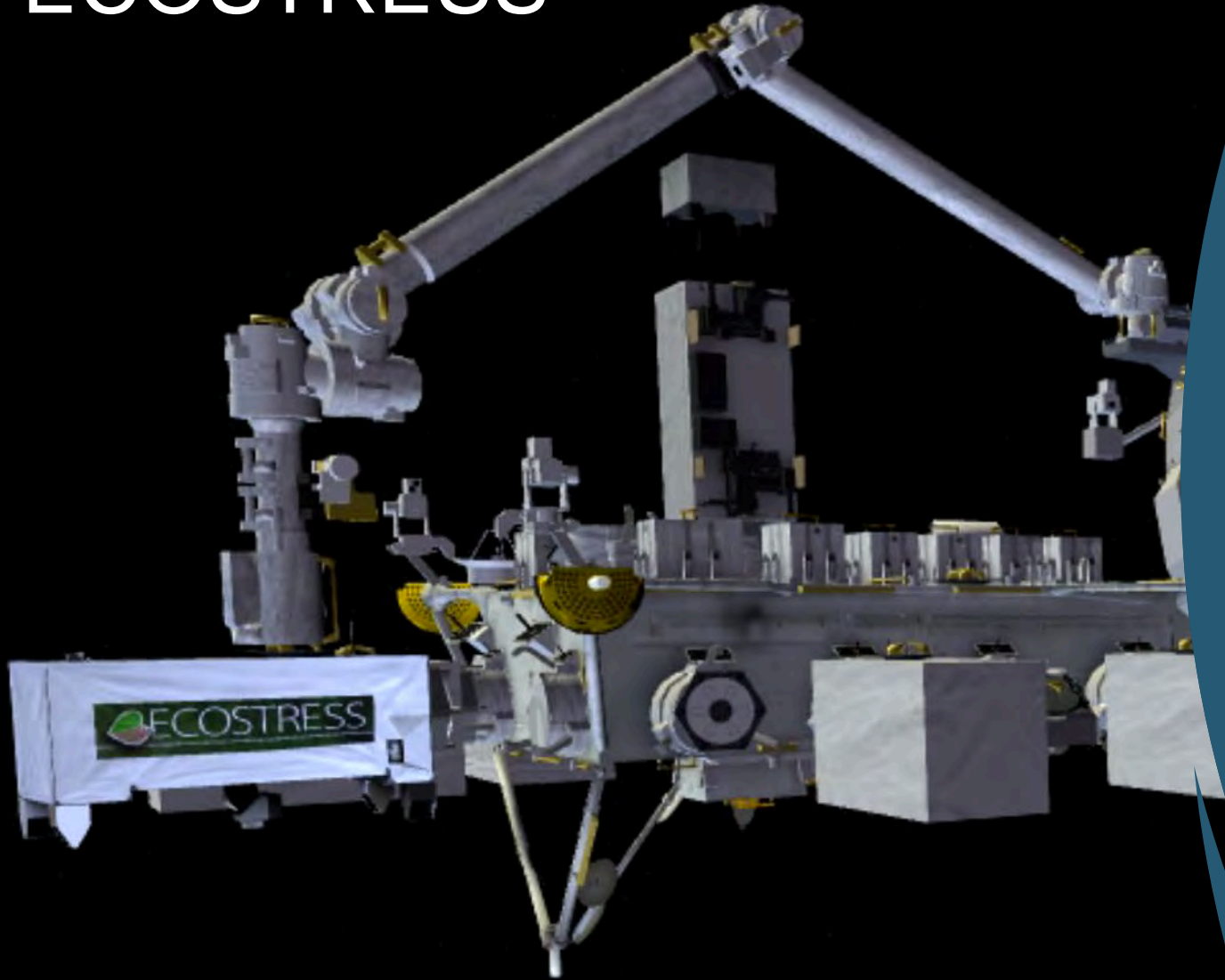
Protect & Improve  
Life on Earth

Search for  
Life Elsewhere

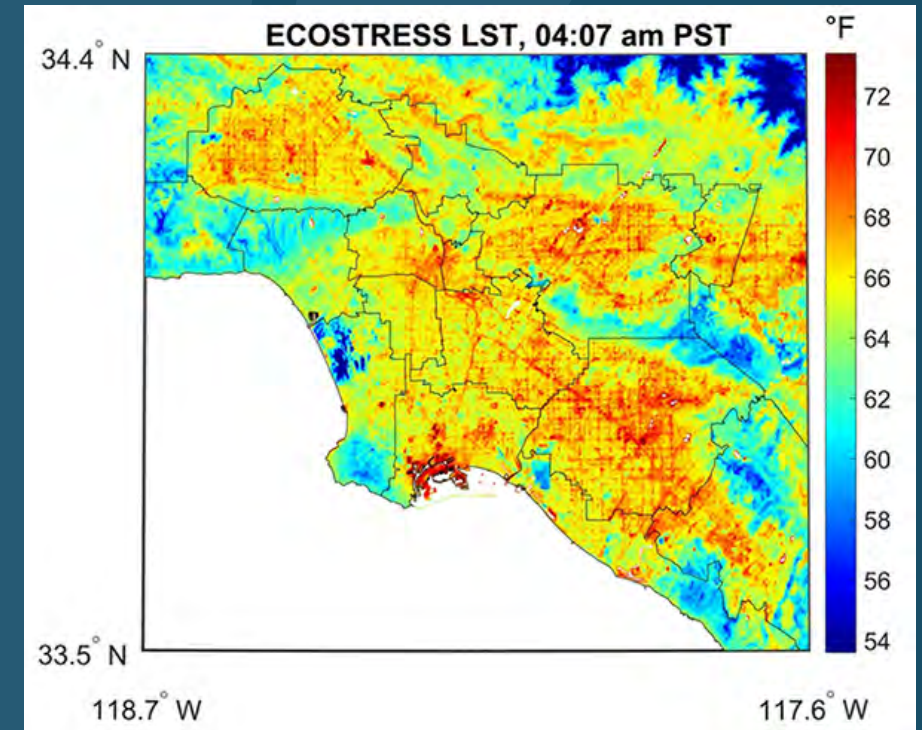
Discover Secrets  
of the Universe



# ECOSTRESS



## SCIENCE HIGHLIGHT

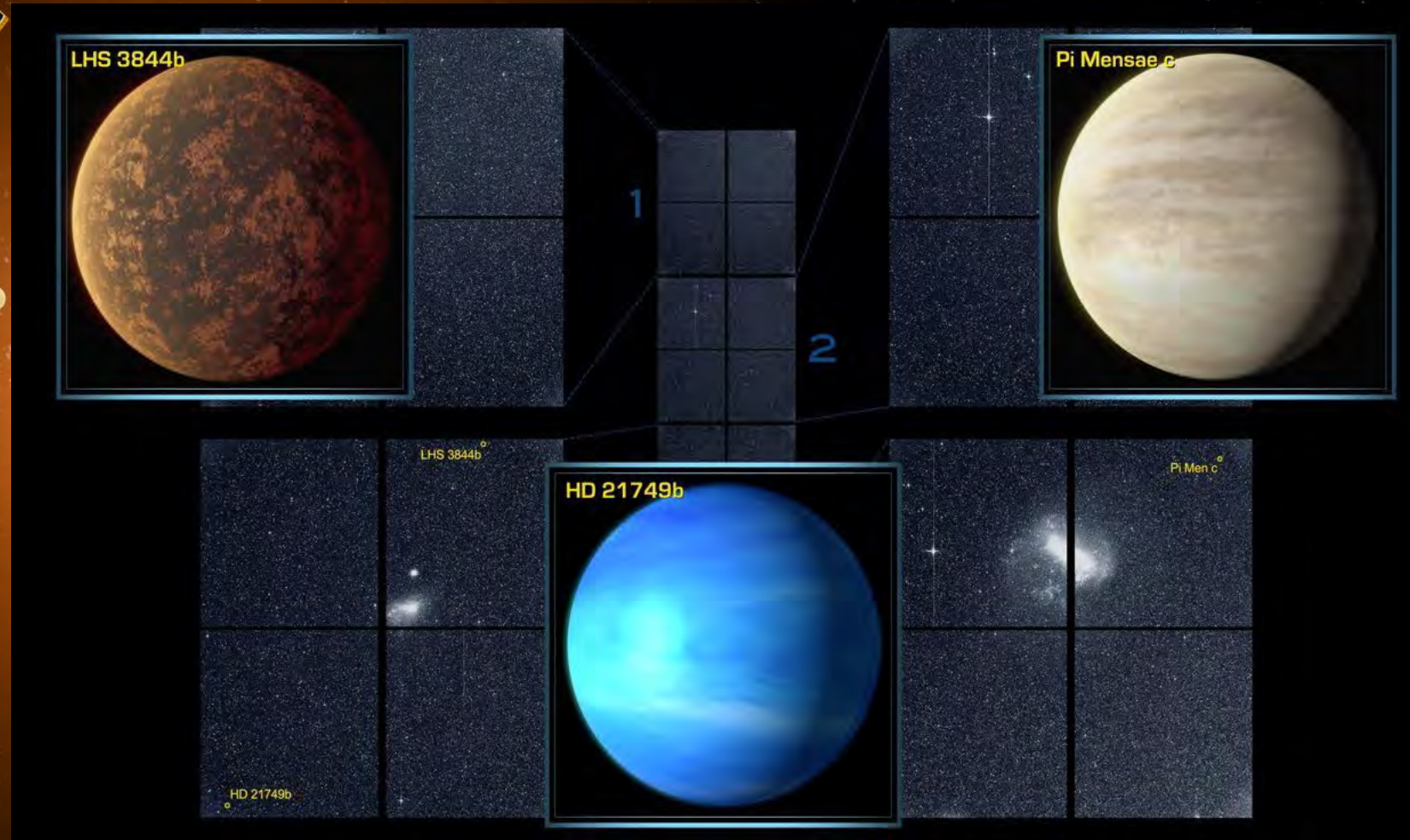
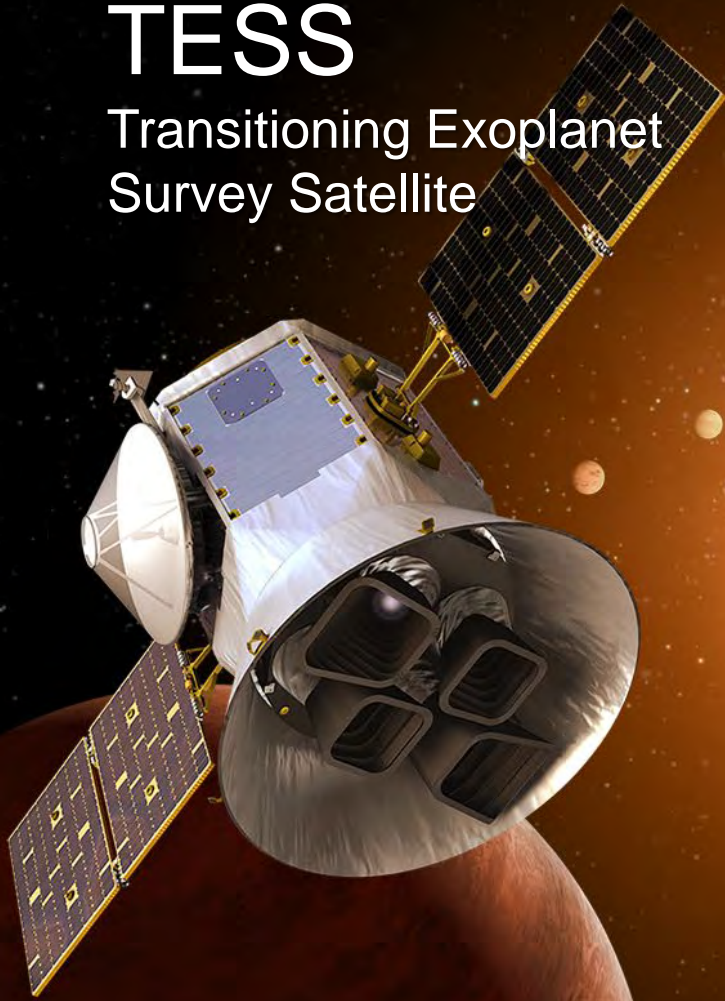


*July 22, 2018 at 4:07 a.m. - ECOSTRESS showing hottest (reddest) areas are dark asphalt surfaces unshaded during the day and remain warm at night*



# TESS

Transitioning Exoplanet  
Survey Satellite



*Jul. 25 - Dec. 11, 2018 - First three confirmed TESS planets: LHS 3844b, Pi Mensae c, and HD 21749b; 398 new TESS planet candidates available for follow up*



**SCIENCE  
HIGHLIGHT**

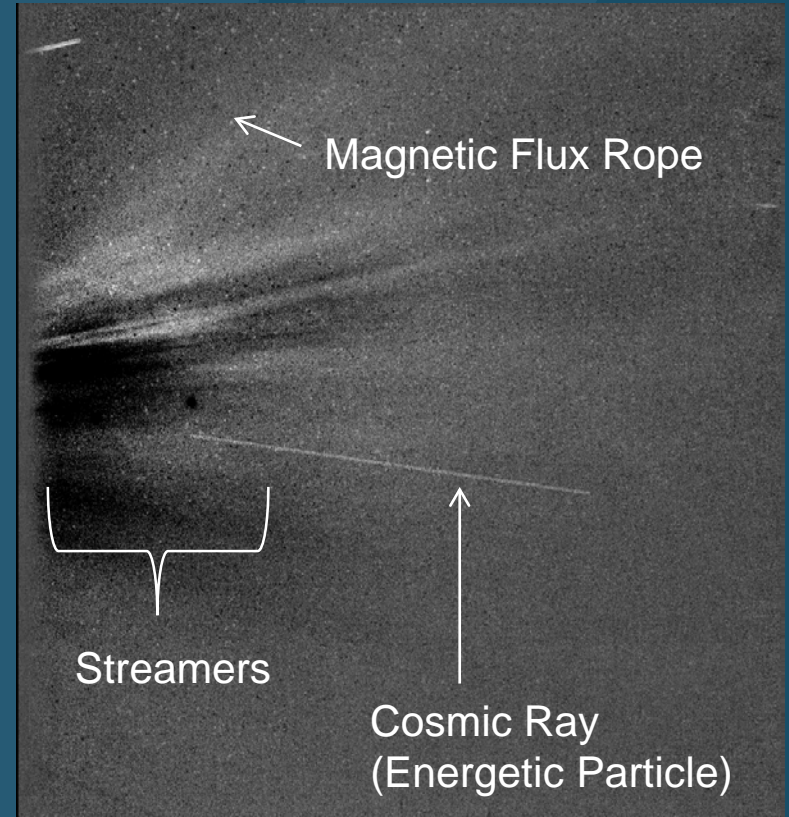


# Parker Solar Probe

A Mission to Touch the Sun



SCIENCE  
HIGHLIGHT



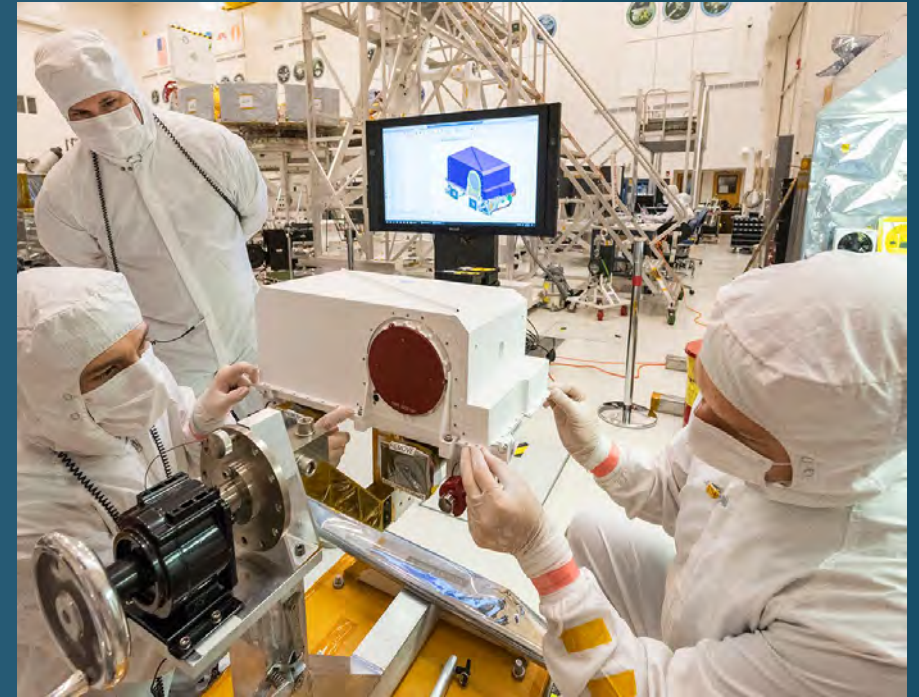
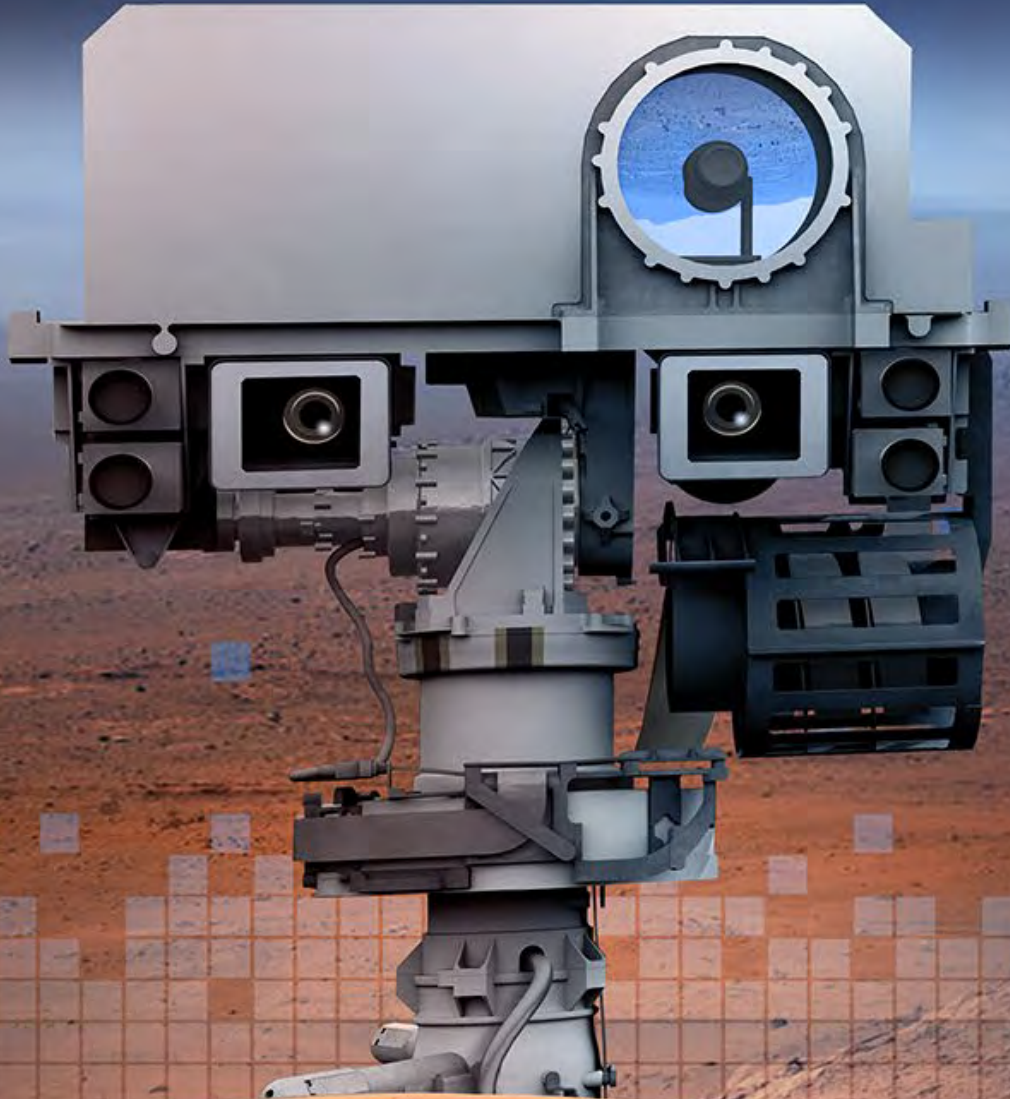
*Nov. 6, 2018, 18:16 UT – Data from  
WISPR instrument on Parker Solar  
Probe during first perihelion*



# Mars 2020



## SCIENCE HIGHLIGHT



*May 23, 2019 - Engineers re-install the cover to the remote sensing mast (RSM) head after integration of two Mastcam-Z high-definition cameras for the Mars 2020 rover at JPL*



# Science Strategy of the Moon

- Driven by community-produced documents
- Achieves Decadal Survey objectives
- Executed to NASA Science research standards
- Enables human exploration
- Uses precursor robotics by the Commercial Lunar Payload Services (CLPS) contract and Gateway opportunities, instrument development awards, AOs, and international contributions
- Develops exploration science mission plan for first human return mission



# Artemis Phase 1: To the Lunar Surface by 2024

MARS 2020

ARTEMIS 1: FIRST HUMAN SPACECRAFT  
TO THE MOON IN THE 21st CENTURY

ARTEMIS 2: FIRST HUMANS TO  
THE MOON IN THE 21st CENTURY

FIRST HIGH POWER  
SOLAR ELECTRIC  
PROPULSION (SEP)  
SYSTEM

FIRST PRESSURIZED  
CREW MODULE  
DELIVERED TO  
GATEWAY

ARTEMIS 3: CREWED  
MISSION TO GATEWAY  
AND LUNAR SURFACE

## Commercial Lunar Payload Services

- CLPS delivered science and technology payloads

## Early South Pole Crater Rim Mission(s)

- First robotic landing on eventual human lunar return and ISRU site
- First ground truth of polar crater volatiles

## Large-Scale Cargo Lander

- Increased capabilities for science and technology payloads

## Humans on the Moon - 21st Century

First crew leverages infrastructure left behind by previous missions

**LUNAR SOUTH POLE CRATER TARGET SITE**

2019

2024



# Lunar Discovery and Exploration Program (LDEP)

LDEP is a key component of the National Exploration Campaign, including

- Commercial Lunar Payload Services (CLPS)
- Instrument Development
  - To fly on CLPS landers
  - Development and Advancement of Lunar Instrumentation (DALI)
- Lunar Reconnaissance Orbiter (LRO) Mission Operations
- Lunar SmallSats - Small Innovative Missions for Planetary Exploration (SIMPLEX)
- Future mobility and orbital capabilities
- Communications/data relay assets





# CLPS Selections

- May 31, 2019 NASA selects first Commercial Moon Landing Services for Artemis Program to deliver science and technology to the Moon
  - Astrobotic of Pittsburgh awarded \$79.5 million to fly as many as 14 payloads to Lacus Mortis, by July 2021
  - Intuitive Machines of Houston awarded \$77 million to fly as many as five payloads to Oceanus Procellarum by July 2021
  - Orbit Beyond of Edison, New Jersey awarded \$97 million to fly as many as four payloads to Mare Imbrium, by September 2020



*Astrobotic*



*Intuitive Machines*



*Orbit Beyond*





## International Partnerships

- The Spacell lunar lander, Beresheet, carried a NASA-provided laser retroreflector assembly (LRA)
- The NASA DSN provided support to the lander team as part of an NASA-Israel Space Agency cooperative agreement
- Chandrayaan-2 will be carrying an identical LRA





# EXPLORE MOON<sub>to</sub>MARS

MOON LIGHTS THE WAY

